

## DRAWINGS ATTACHED

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## (54) METHOD OF MAKING A SKIN COVERED FOAMED ARTICLE

(71) We, THE GOODYEAR TIRE & RUBBER COMPANY, a Corporation organized under the Laws of the State of Ohio, United States of America, of 1144 East 5 Market Street, Akron, Ohio, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of making decorative articles having a flexible foam interior and to said articles. More particularly, this invention relates to a method of making interior articles or decorative elements for automobiles and other vehicles, furniture and other related equipment or assemblies having a skin thereon and a means for attaching the article to an assembly.

Heretofore in the preparation of skin covered foamed articles such as the interior or decorative elements of an automobile or furniture and other related equipment or assemblies, it has been customary to obtain the reinforcing and attaching means by stamping from metal or plastics sheet, or injection molding, and these reinforcing and attaching means are placed in the mold and the mold is locked with the attaching member held in a fixed position with magnets or related attaching means such as pins or hooks. This method of operation has presented the problem of timing the mold closing and also a method of attaching the reinforcing and attaching member to the mold where it could be readily released. Where the element is resinous or plastics in nature magnets are not effective for holding and positioning the element.

An object of this invention is to provide a method for making a reinforcing and attaching member on the lid of the mold per se and then positioning this reinforcing

and attaching member within the mold when the lid is closed thereby to position the reinforcing and attaching member automatically within the mold.

The objects and advantages of this invention can more clearly be seen by reference to the drawings wherein

Fig. 1 is a cross-section through a mold and its lid showing the lid displaced slightly from the mold as the lid is closed; 55

Fig. 2 is a perspective view of the mold shown in Fig. 1; and

Fig. 3 is a view of the lid of the mold of Fig. 1 in the open position showing a reinforcing and attaching member formed 60 thereon; and

Fig. 4 is a cross-section through the finished article molded in the mold of Fig. 3.

In the practice of this invention the lid 65 for the mold is first given a coat of a fluid plastics material suitable for forming the reinforcing and attaching means. It is also desirable that the lid have positioned thereon suitable attaching means such as bolts or grommets at the time the fluid plastics material is applied to the lid and set or congealed to form the means which is releasably adhered to the lid. The cavity of the mold preferably has therein a skin 75 formed of a suitable material such as a polyvinyl chloride or a polyurethane, and then a suitable foamable mixture is added to the cavity of the mold and the lid is closed thereon. The foamable mixture is 80 caused to foam and fill the mold thereby to adhere the skin to the reinforcing and attaching means. The material in the mold is subjected to a curing operation, preferably at elevated temperatures from 100 to 85 300°F. to cure the foam to bond the skin and the reinforcing and attaching element satisfactorily into an integral article having the desired shape and aesthetic effects.

Referring more particularly to the draw- 90

[Price 25p]

ings. the numeral 5 represents the skin of the article which may contain the desired decorative effect such as a simulated sewn seam or embossing or related aesthetic embellishments to give the skin the effect of fabric, leather or other desirable appearance. The skin may be formed by any of the conventional means such as vacuum forming of any of the thermoplastic resinous films which have embossed thereon the desired decorative effects. Alternatively, the skin 5 may be formed by slush molding or rotational molding or other molding techniques or even made by spraying a suitable film forming material into a mold and curing to set it where the skin will retain the desired contour. The skin is placed in a suitable retaining mold 8 or it may remain in the mold in which it was formed and then a suitable foamable material 11 is added to the cavity of the skin, the amount added is preferably just sufficient to foam and fill the skin when the skin has placed therein a reinforcing member 6 by closing the lid 9 on the mold. The reinforcing member 6 preferably has also means 7 such as a bolt or grommets for attaching the finished article to the final assembly, for instance, to the upright or side of the interior of an automobile. The reinforcing member 6 may be placed in the mold just after the foaming of the foamable material is initiated, or slightly later when foaming is already taking place. Thus, when the foaming of the foamable material is completed the skin will be filled with a foam which will be adhered to the skin and also be adhered to the reinforcing member 6. Thus, we obtain the finished article shown best by numeral 14 of Fig. 4.

When the foam of the finished article has been fully cured, the article may be removed from the mold by opening the lid and removing the article ready to be attached to the finished assembly. For instance, where the finished assembly is an automobile and the decorative article is for an A-post of the automobile. (i.e. the post between two doors in a 4-door car), the attaching means 7 would be placed within the proper receptacles within the door A-post to attach the article to the automobile and thus achieve the proper decoration of the interior of the car with a corresponding improvement in safety.

Preferably the skin is made from a plastics, preferably a thermoplastic or setting material such as polyvinyl chloride, an acrylonitrile-butadiene-styrene graft copolymer or it may be polyurethane or any of the other suitable thermoset resins that are normally used in making skins for car cushions, crash pads and related articles.

The reinforcing member 6 may be made by pouring the liquid plastics material, pre-

ferably a foamable mixture producing a rigid or semi-rigid formed material, upon the lid of the mold, the lid having previously been coated with a release agent such as a polyethylene wax, and then effecting the setting or congealing thereof with or without foaming of the material to obtain a reinforcing member having one surface which is essentially nonporous; although the member, if desired, may be of essentially the same porosity from top to bottom. It is desired that suitable attaching means such as screws, nuts or grommets be positioned at the appropriate place in the mold and thus these attaching means become an integral part of the finished reinforcing member. It should be evident that a semi-rigid or rigid polyurethane would be excellent for this reinforcing member, although it should be appreciated that other foamable materials such as polyethylene, polypropylene, polyvinylchloride, polystyrene, and other resinous or rubbery materials could be utilized. The preferred foam is one that has sufficient resistance to tearing, so that the attaching means are not easily torn out. These foams are sometimes referred to as nailable foams and are relatively heavily loaded with fillers, for instance, 25 to 100 parts per 100 parts of resin.

The foamable material utilized to produce the foam which adheres the skin to the reinforcing member is preferably one giving a flexible or semi-rigid foam rather than a rigid foam; and it may be any of those well known to the art but preferably is a polyurethane, such as those that are normally used in making seat cushions or crash pads for the automobile industry.

Surprisingly, a finished article such as an A-post element which utilizes a rigid foam reinforcing member instead of the conventionally used sheet metal stamping is capable of undergoing severe deflection without permanently bending, twisting or otherwise distorting.

Illustrative of this invention is the following example:

A decorative skin was formed by spraying a polyurethane reaction mixture onto an embossed mold and curing the mixture. Their skin had the physical contour of that shown in Fig. 4. A foamable polyurethane mixture was added thereto in an amount sufficient to fill the cavity of the skin when the foaming was complete. This foamable mixture comprised a mixture of polypropylene ether glycol and polypropylene ether triol, toluene diisocyanate, a small amount of water and dichlorofluoroethane and catalyst N-ethyl morpholine and triethylene diamine, then a reinforcing and attaching member preformed on the lid in the manner shown in Fig. 3 was lowered into the mold by closing the lid on the mold

as shown in Fig. 1. The foamable reaction mixture was allowed to foam and fill the mold, to adhere the skin to the reinforcing and attaching member. Thus, when the lid was open after the polyurethane foam had been cured, a finished article suitable for decorative and safety padding on an automobile door A-frame was ready to be removed from the retaining mold.

The reinforcing and attaching member is preferably made from a semi-rigid to rigid foam. The preferred material for making this reinforcing member is a polyurethane foamable mixture known to the art. A preferred one comprises a mixture of polypropylene ether triol and tetrol with a small amount of a trifunctional monomeric cross-linker such as trimethylol propane which is reacted with an isocyanate such as toluene diisocyanate or a polyphenylene methane polyisocyanate in the presence of a blowing agent such as water and/or methylene chloride or a fluorohydrocarbon. To insure that the rigid or semi-rigid foam has sufficient resistance to tearing it is preferred that this foamable recipe contains on a hundred parts of polyether-polyol basis from about 25-50 parts of a cellulosic material such as sawdust or nutshell flours. As the reinforcing and attaching means is made by pouring a suitable fluid mixture onto the lid, it is preferred that suitable attaching means, such as bolts or grommets, are positioned within the recesses of the lid of the mold and embedded within the rigid foam member.

Referring to Fig. 3, it will be seen that the lid or cover for the mold in the open position exposes the underside of the lid. Also, it will be noted that the lid has openings therein to receive screws or attaching members 7. These screws are placed within the holes of the lid after the lid has been given a coat of a mold release agent, such as a pentane or low boiling naphtha solution, of a water dispersion of polyethylene, with the lid being sufficiently hot to evaporate the solvent and give a uniform coating of the melted polyethylene thereon. Then a foamable material is distributed on the lid along the line 10 and within the removable frame 13. The amount of foam applied is adjusted so that the foamed material will not overflow and spill off of the lid. As soon as the foamable material has foamed and set to the point where it is self-supporting and would not collapse when moved, the lid of the mold is then placed on the mold to bring the reinforcing and attaching member into the relationship shown in Fig. 1 to the rising foam 11 in the skin within the retaining mold.

It should be appreciated that, although rigid to semi-rigid polyurethanes are preferred for forming the attaching and re-

inforcing means, if the mold lid is sufficiently elevated in temperature, for instance at 200 to 300°F., other foamable materials such as those formed by using thermoset resins, for instance, polyvinyl chloride, may be utilized where these materials are compounded with a blowing agent such as the azo nitriles or peroxy carbonates and other blowing agents normally used in blowing thermoset resins.

Heretofore in this application we have discussed the fact that a preformed skin is placed in the mold and then the foam is foamed to form the desired article. Alternatively, the skin may be formed *in situ* by the well-known techniques of cooling the mold or having the temperature of the mold below that of the foaming mixture, whereby an integral skin is formed simultaneously with the generation of the foamed core or body of the article. The technique for forming integral skins *in situ* is described in U.S. Patent 3,099,516 and this method and others known to the art may be utilized to form integral skins simultaneously with the formation of the article.

In the embodiment shown, a frame coated with a suitable release agent was placed on the lid and then the fluid plastics material such as a fused polyvinyl chloride containing fine asbestos fibers dispersed therein to form the reinforcing and attaching member was added and allowed to congeal or set until it would retain its shape. Then the frame 13 is removed, the lid is closed on the mold which has a foamable mixture therein, and the foaming thereof is effected to bring the foam into contact with the reinforcing and attaching means, thereby to obtain the article having the foam, skin and reinforcing means bonded into an integral article.

#### WHAT WE CLAIM IS:—

1. A method of making a skin-covered foamed article having an integral reinforcing member, by causing a foamable material to foam in the cavity of a mold, so that the foam adheres to the skin and to a reinforcing member releasably adhered to the lid positioned over the cavity of the mold, the skin being either performed or formed *in situ*, in which the reinforcing member is made by applying a sufficient amount of a fluid plastics material to the lid of the mold.

2. A method according to claim 1, in which the lid has positioned thereon a frame to retain the fluid plastics material until it congeals.

3. A method according to claim 1 or claim 2, in which the fluid plastics material is a foamable mixture.

4. A method according to claim 3, in which the fluid plastics material is one

producing a rigid or semi-rigid foam.

5. A method according to claim 4, in which the fluid plastics material is a polyurethane foamable mixture.

5 6. A skin-covered foamable article having

an integral reinforcing member, when made by the method of any preceding claim.

MARKS & CLERK

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